DØ Upgrade Project Progress Report

FY99 - Fourth Quarter
Jul-Sep, 1999

Summary

Significant areas of progress during the quarter included:

- The start of VLPC module production
- The start of full production for the calorimeter preamps, preamp motherboards, and calibration system
- The successful readout of cosmic ray muons using a complete WAMUS detector readout chain, beginning with a detector and its prototype front-end electronics, and ending with the software that unpacks and examines the data.
- The final delivery of scintillation counters for the forward muon trigger system, and the assembly and testing of all A-layer octants for that system.

Areas of concern primarily centered on:

- Delays in the delivery of HDI and "jumper" flex circuits.
- Production rates for some silicon detector types
- Dimensional stability problems with the plastic connectors for the fiber tracker ribbons

Following a recommendation from the June 1999 DoE review, a comprehensive reevaluation of the project schedule also was begun during this quarter.

This is the final quarterly report for the DØ upgrade. Subsequent reports will be produced on a monthly basis, beginning with the month of October, 1999. These reports will include an expanded list of approximately 90 "reportable" milestones.

Subproject Progress

Solenoid (WBS 3.1.1)

Cryo-system

Parts for the helium gas-purifier are nearly complete. These include: two coded vessels, a heat exchanger, and the charcoal bed vessel through which the gas is passed for purification. An arc cell for measuring the helium purity also has been manufactured at Fermilab.

Magnet Measurements

The mechanical frame and beam system that locate the Hall probes inside the solenoid volume have been tested for accuracy in measurement point location. Re-alignment of the four Hall probes that are used to measure radial and axial fields was completed. The month of September was devoted to measuring the magnetic field during the evening shifts (4 pm-to-midnight).

Beam Pipe and Shielding

Most of the forward-shielding components have been procured, and their pre-assembly is scheduled to begin during the next quarter. The beryllium beam tube is being fabricated at Brush-Wellman in Fremont, CA. They have experienced problems building this very thin-walled assembly that must be baked at high temperatures without the creation of leaks. Recent reports (two per week) indicate good progress.

Tracking System (WBS 1.1)

Silicon Tracker (WBS 1.1.1)

9-chip ladders

The second 9-chip ladder fixture was commissioned and production is proceeding with two fixtures. The production rate has recently been increased from two to four ladders per week.

3-chip ladders

Production has resumed with two fixtures. The production rate is five ladders per week and can be increased to ten per week if necessary.

6-chip ladders

The first 6-chip ladder fixtures were qualified in September. Mechanical ladder assemblies were built and the first production ladders should be produced by the first week in October. Fifteen 6-chip HDI assemblies were fabricated. Production is expected to begin in mid-October.

H-disks

Production of half-wedges was halted due to lack of HDI assemblies. 120 were fabricated in September and full-speed production is now ramping up.

F-disks

Several electrical and mechanical pre-production prototypes were fabricated. Full production is awaiting the "jumper" flex circuits that are about six weeks late. Fifteen of these assemblies were received and will be used for the first production batch in early November.

10% Test

The readout system has been moved into lab C in preparation for the 12-ladder test. The associated absorber and counters are deployed. The first ladders should be installed into barrels in October. First readout tests were performed with the "final" readout system, including: interface cards, low- and high-mass cables, and final versions of the sequencers and VRBs.

Testing and Repair

Two stand-alone sequencer-based burn-in stations are in operation and were used for first final tests on production ladders.

Fiber Tracker (WBS 1.1.2)

An unexpected problem has been discovered with the curved connectors for the scintillating fiber ribbons and clear-fiber waveguides. The connector material, Torlon, is not dimensionally stable. Depending on humidity (absorbed moisture in the material), the connector width can change by as much as ten mils (0.01"). For this reason, all Torlon components have been rejected. This includes connectorized ribbons as well as unused connectors. The parts will be replaced by connectors made from aluminum or another plastic (Techtron). For cylinder 8 and 7, aluminum connector material will be used (Al connectors for the ribbons on cylinder 8 already exist). A decision on the connector material for the remaining ribbons will be made once mechanical and physics studies are completed. This introduces a four-to-six week delay in the schedule. Meanwhile, new fiber has been ordered, and a delivery schedule from the vendor (Kuraray) will be available shortly. The final connectors will be made in the Fermilab main machine shop. They have developed a good manufacturing technique that produces parts to the required specifications at approximately one-third the cost of having them made by outside vendors. In spite of the connector problem, ribbon production has continued unabated. Carbon fiber work also continued, with support cylinders 8, 7, and 6 now complete. Ribbon mounting for cylinder 3 also was completed (first production cylinder). This cylinder was made with ribbons using Torlon components. However, this is still considered a production cylinder, pending a final decision on its use in the detector.

The VLPC flex circuit order has been placed with Compunetics and first deliveries are expected early in the first quarter of FY00. Also, VLPC module production began on 20-Sep-99.

Preshower Detectors (WBS 1.1.3, 1.1.4)

Central Preshower

(No report - detector is installed.)

Forward Preshower

All large detector modules have been fabricated and twenty-three have been cabled. A means of dry-cutting modules using an end-mill was developed, twenty-six of the thirty-five small modules that are needed

(including spares) were cut, and five of them were cabled. After considerable down time due to problems with the diamond-polishing machine at Fermilab, the final connector assemblies are being fabricated and shipped to Brookhaven, where the cabling of the modules continued. The final pieces of the detector support structure -- lead absorber wedges, stainless steel backing shells, alignment and construction tooling for the lead, and the 1.5-meter-diameter lead support ring -- are now in shops at Brookhaven, Stony Brook, and a local outside vendor. A support frame has been designed and built for the 300-pound wooden dome-shaped mock up of the cryostat head, and the support dome has been mounted on it in a vertical position. This will allow the mock-up of all steps in the installation procedure for the forward preshower. Precision alignment of the support ribs and rings on one of these domes is 50% complete.

Tracking Electronics (WBS 1.1.5)

Approximately 150 of the 200 VME Readout Buffer boards (VRBs) and 200 of the 225 VME transition modules (VTMs) were received and sent to PREP for initial checkout and repair, if necessary. The remaining modules are due in October. Satisfactory pre-production SVX sequencer boards were received and the manufacturer was told to start the production order, with delivery scheduled to begin in November. Pre-production VRB controller boards also were ordered, with delivery expected in early November. Lastly, rack preparation work for these modules began in the moving counting house, with completion of the first rack expected in late October or early November.

Calorimeter System (WBS 1.2)

Electronics (WBS 1.2.1)

Full production of calorimeter preamps (60,000), preamp motherboards (1,200), and the calibration system began. In addition, significant progress on the detector infrastructure was made. Pulser cables for the central and the north end-cap calorimeters (CC and ECN) were installed and terminated, and the preamp power supplies are under construction, with the final monitor cards expected at the start of the next quarter. The BLS system has progressed to final prototypes for fifty pieces of the daughter card and ten pieces of the motherboard. A pre-production order for 5,000 shapers was placed. The switched capacitor arrays (SCAs) produced on the 6" line showed significantly higher yields (>65%) than those on the 4" line. Devices from the additional 32-wafer order on the 6" line were received and they are presently being packaged. Another 16 wafers were manufactured but not purchased, giving further opportunities for spare devices should future yields be lower than expected. Given the present yields, those devices that are in hand should be sufficient. More than 70 wafers from the 4" line have not yet been diced and packaged. This is because the effects of packaging and bonding on these devices are still being studied. If the expected yields hold, then these devices would be spares. Manpower has been added to the commissioning effort with the addition of a student to work on development of the EXAMINE software. Lastly, discussions about refurbishing the argon purity monitoring electronics began.

Intercryostat Detector (WBS 1.2.2)

All supertile machining at Lab 8 was completed and the tiles were sent to the University of Texas at Arlington (UTA) where thirty-five of forty supertiles were assembled. Cutting, polishing, and mirroring of the wavelength shifting fibers were completed and all wavelength-shifting fiber pigtails were assembled. The aluminum boxes and all associated parts were fabricated and delivered, and a problem with the box lid was corrected. The cosmic ray test stand at UTA was expanded to allow simultaneous testing of all twelve subtiles in a supertile. Initial tests indicated good uniformity of response from a given subtile from one supertile to the next. A potential new manufacturer was identified for the 5-meter clear-fiber cables. The company, Fiber Systems International of Dallas, is developing a design for the fiber sheathing and its connection to the fiber connectors. Tests of phototube behavior were carried out in the fringe field of the solenoid and the central iron toroids. One phototube was operated with LED light input inside the iron shielding block mounted in a "pig trough". No significant reduction in the its output was detected when the solenoid and toroids were fully energized under various field polarities. However, a phototube operated outside the iron block showed normal performance with the magnetic fields off, but no response when the fields were on. Progress also was made at Louisiana Tech. on the readout electronics. The noise previously seen has been significantly reduced. A new layout for a single channel on the motherboard was completed and is being prototyped. Work also began on a six-channel design motherboard.

Muon System (WBS 1.3)

Central Detectors (WBS 1.3.2)

The WAMUS system has taken the lead in the commissioning of the online system. During August, the prototype front-end electronics, prototype muon counting house electronics, Level-3 online software and readout, and the software involved in unpacking and examining the data generated by cosmic ray muons were all exercised. This was a DØ Run II first and a milestone on the way to a commissioned detector and online system. In the A-ϕ system, all 540 installed counters were cabled, and the "A-layer floor" that will protect the remaining 90 counters was designed and purchased. In the Cosmic Cap and Bottom scintillation counter systems, good progress was made in the cabling and installation of the calibration system.

Forward Trigger Detectors (WBS 1.3.3)

- Production and testing of A-layer octants was finished, and no major problems were identified.
- Production of C-layer octants started on schedule. Four octants were completely assembled and tested and all parameters of the octants were within specifications.
- Design of B-layer counter planes was completed and the frames were ordered from industry.
- All 4608 counters have been delivered from IHEP to Fermilab, and forward trigger detector production is on schedule. The major remaining tasks are to keep the octant assembly and testing at Lab F on schedule, and finish the engineering design work for octant installation.

Forward Tracking Detectors (WBS 1.3.4)

- Full-scale assembly and testing of MDT tubes at the Joint Institute for Nuclear Research continued at a steady rate. 66% of the needed tubes have been assembled and tested at Dubna. All A-layer tubes have been delivered to Fermilab and all C-layer tubes have been shipped to Fermilab.
- 1600 A-layer tubes have been tested at Fermilab and are ready for installation. There are no remaining unsolved technical problems with the MDTs.
- Problems with flat honeycomb panels delivered for the A-layer are still not resolved, so the order for the B- and C-layer panels has not been placed yet. New vendors are being identified, while work with the current vendors continue in an effort to improve their product.
- All parts for the A-layer octants have been designed and ordered. Pre-assembly of the first octant was completed with no problems seen.
- Survey results from the first octant demonstrate that the mini-drift tubes are located on planes within specification.

The forward muon tracking detector is close to the critical path. A major goal is to start final octant assembly and testing as soon as possible. Currently this is limited by the availability of parts ordered in late September.

Muon Electronics (WBS 1.3.5)

The production of the final WAMUS front-end boards began. Ten percent of the MDT electronics have been produced and tested, and a setup is assembled at Lab F based on these modules. Production of ten percent of the scintillator front-end cards (SFEs) also started. The muon readout card (MRC) production began, but was somewhat delayed due to vendor problems with parts procurement. Scintillator readout card (SRC) debugging also has been somewhat delayed but is not on the critical path. The muon fanout card (MFC) design was completed and submitted for production.

Trigger/Online (WBS 1.4, 1.5)

Framework (WBS 1.4.1)

Communication was established between the Level 1 Framework and front ends and Level 3, and the Level 2 Framework firmware design was completed.

Luminosity Monitor (WBS 1.4.2)

The Luminosity Monitor detectors neared completion. The enclosures were fabricated, circuit boards for the PMT preamplifiers and LED drivers were designed and fabricated, and the LED calibration/monitoring light source design was finalized. Progress also was made on the two VME boards needed for the Luminosity Monitor electronics. The design of the analog section was completed, and the CAFE cards are now in production. The FPGA's for the ADC board neared completion, and the remainder of the design is being finalized. Work also began on the FPGA's for the vertex board that generates the trigger signals from the Luminosity Monitor measurements.

Level 1 (WBS 1.4.3)

Work on the design of the Level 1 calorimeter electronics, Level 1 central tracking preproduction and design, and Level 1 muon preproduction continued and is on schedule. A new feature of the Level 1 calorimeter trigger includes the capability to dynamically adjust trigger tower thresholds. This will greatly facilitate data-taking. The Level 1 CFT 8-Multi-Chip-Module (MCM) Analog Front End (AFE) returned from layout and is being checked, while a prototype board is being bid. The 12-MCM AFE, used for preshower triggering, is in the schematic stage with all design constraints specified. The Digital-Front-End (DFE) motherboard, used to accept and trigger on the analog signals, was finished and tested. The design of the collector/broadcaster system, which collects the results from the eighty DFE's and sends the final trigger on to the framework, proceeded and it appears that only two separate types of daughter boards will be needed. Level 1 muon trigger work focused on testing the preproduction version of the muon trigger crate manager. The preproduction version of the muon trigger card was fabricated, testing of preproduction versions of all serial link daughter boards was completed, testing of the first prototype muon centroid crate manager occurred, and tests of the high speed backplane readout are underway.

Level 2 (1.4.4)

Most of the Level 2 component cards have been prototyped and are in production, or expected to be during the next quarter. The Alpha board layout was completed and a quote for fabrication was received. The first Magic-Bus-Tranceiver (MBT) prototype has passed tests, and five full prototypes are being manufactured. Progress on the SLIC card has been good this quarter. All PC boards for the twenty SLIC motherboards and for ninety-six DSP daughterboards were fabricated and are currently at the assembler. The University of Nebraska--Lincoln group has accepted responsibility for the CIC and SFO cards. One VME crate of the Level 2 order of twelve was delivered; the rest are now promised for November. Work on rack design also has begun. Design and specification of the individual preprocessor contents and algorithms continued. There have been several engineering meetings concerning the Silicon Track Trigger (STT) preprocessor. Highlights of the design include: use of standard 9U VIPA cards and a common motherboard for all STT cards, with daughter cards to provide functionality for data receiving, transmission, and processing.

Level 3/DAQ (1.4.5)

Work continued on the basic hardware and related software for the Level 3 trigger/data acquisition. The final set of changes requested for the VME buffer readout board was tested with both calorimeter and tracking electronics, and approval was given to proceed with the upgrade for all these modules, both the extended and non-extended versions. Additionally, design work was completed for the upgrade on the buffer memory boards (MPM), and good progress was made towards finalizing the design of the readout collector module that receives data from the buffer readout boards. The data acquisition system at DØ remained in use, although more constant operation will begin soon, once the digitizing crates are linked to the trigger framework. A key part of the readout involves the separate link of the hardware trigger information to the Level 3 system. The hardware for this link was recently tested successfully. Operation of the Level 3/DAQ system for the silicon electronics test continued, and at the end of this period the system was moved to Lab C to be incorporated as part of the silicon detector 10% test. Components are being assembled to create a similar system for use at the central fiber tracker facility. Progress on Level 3/DAQ software included upgrades on the framework that runs in a Level 3 filter node. This important package is nearing its final state.

Online (WBS 1.5)

A high-bandwidth backbone Ethernet network switch was purchased and is undergoing tests at the Computing Division, and some Linux nodes were purchased for event-monitoring applications. Single-crate readout of

Silicon, Muon, and Calorimeter was demonstrated. The data were simultaneously passed to and analysed on monitoring nodes. A Python interface to asynchronous EPICS channel access routines was developed as a foundation for quickly developing user applications. Interactive Web pages and a batch entry mechanism for the hardware databases were released. An EPICS database was generated from ORACLE database contents. The calibration system design was completed and prototypes have been written for central processes and user interfaces. The databases for the SMT and Calorimeter were designed and unified with Offline database needs.

Milestone Summary

For consistency with previous quarterly reports, the following table lists DoE (M1) and Director's (M2) milestones whose Jan '98 baseline dates fall before the end of the fourth quarter of FY99. (Milestones reached *prior to* the fourth quarter have been deleted from the list.). One Director's milestones was met during the quarter. For completeness, the recently established Oct '99 baseline dates also have been included. In future monthly reports, all reportable milestones (~ 90 total) will be included, and variances only with respect to the current (i.e. Oct '99) baseline will be reported.

FY99Q4

Completed Milestones	*Reached On*
M2-First Cylinder Complete	9/2/99

Not Yet Completed Milestones	*Scheduled Date*	*Oct '99 Baseline*	*Jan '98 Baseline*
M2-Fiber Tracker Assembly Begun	1/4/00	12/6/99	9/21/98
M2-First Silicon Tracker Barrel/Disk Module Complete	2/2/00	1/24/00	10/20/98
M2-Calorimeter Preamp System Test Complete	4/4/00	3/31/00	3/25/99
M2-All Muon Forward Tracker MDT Modules At Fermilab	3/10/00	3/10/00	4/21/99
M2-ICD Modules Arrive at Fermilab	1/18/00	1/25/00	6/17/99
M2-Calorimeter BLS Assembly Complete	9/26/00	9/26/00	6/24/99
M2-Fiber Tracker Assembly Complete	5/4/00	5/4/00	6/30/99
M1-Central Silicon Complete	9/18/00	9/18/00	8/9/99
M2-Muon Electronics Preproduction Installation Complete	12/13/99	12/13/99	8/13/99
M2-Silicon Tracker Installed in Solenoid/Fiber Tracker	9/25/00	9/25/00	9/7/99
M2-Muon End Toroids Installed on Platform	11/15/00	11/15/00	9/23/99

Fermilab Technical Effort Summary

This section presents a table summarizing the reported Fermilab technical effort during the quarter for each WBS Level 2 Subsystem. This includes reported effort from various engineering and technical teams and technical centers at Fermilab, but does not include physicist or project management effort. Units are in FTEs per quarter. CP - Computing Professional, DES - Designer/Drafter, EE - Electrical Engineer, ET - Electrical Tech, ME - Mechanical Engineer, MT - Mechanical Tech.

DØ Upgrade Reported Effort for Jul - Sep 99
(Fermilab FTEs)

WBS Level 2 System	CP	DES	EE	ET	ME	MT	Total
Other		2.6	0.3	0.8	0.5	0.3	4.5
Tracking (1.1)		4.4	4.3	4.6	6.6	23.1	43.0
Calorimeter (1.2)			1.8	1.1		1.0	4.0
Muon (1.3)		4.3	5.3	7.1	1.6	5.6	23.8
Trigger (1.4)		0.1	1.8	0.0		0.0	1.9
Online (1.5.1)	3.6					0.1	3.7
Solenoid (3.1.1)		0.1	0.8	0.0	1.1	2.7	4.8
Total	3.6	11.5	14.3	13.7	9.9	32.7	85.6

Cost Report

Fourth Quarter Fiscal '99 Financial Highlights

The final quarter of fiscal year 1999 closed with obligations for the DØ Upgrade Project totaling $8,265K on equipment M&S funds and $358K on Solenoid AIP Plant funds. As shown in the following table and plot, obligations fell short of planned equipment M&S spending by $1,645K. While obligations did fall short of the plan, actual hard obligations totaled $7,753K, leaving only $235K of the FY99 budget allocation unobligated. Additionally, at the close of FY99, the Upgrade had open requisitions in the system which together with obligations exceeded the $7,988K budget.

The M&S Upgrade Project balance is currently $4,737K, excluding contingency. Roughly $1,500K of the M&S balance is being covered by contributions from various foreign collaborators. The balance in AIP funds is $320K. The remaining contingency is currently being reevaluated due to additional changes to the Upgrade Project's Cost Estimate. During the fourth quarter, several change requests (increases) to the Cost Estimate have been submitted which appear to have a significant impact on available contingency.

The Project currently has commitments with universities and other institutions in the DØ Collaboration, via active Memoranda of Understanding (MoU), totaling $9,474K. These funds represent an obligation on the part of the DØ Upgrade Project and are regularly costed each month via invoices received from the institutions as work is completed. In addition, several institutions have made significant contributions to the DØ Upgrade. The last table shows a list of the universities and other institutions that are involved, as well as a more detailed breakdown of the commitments and costs.

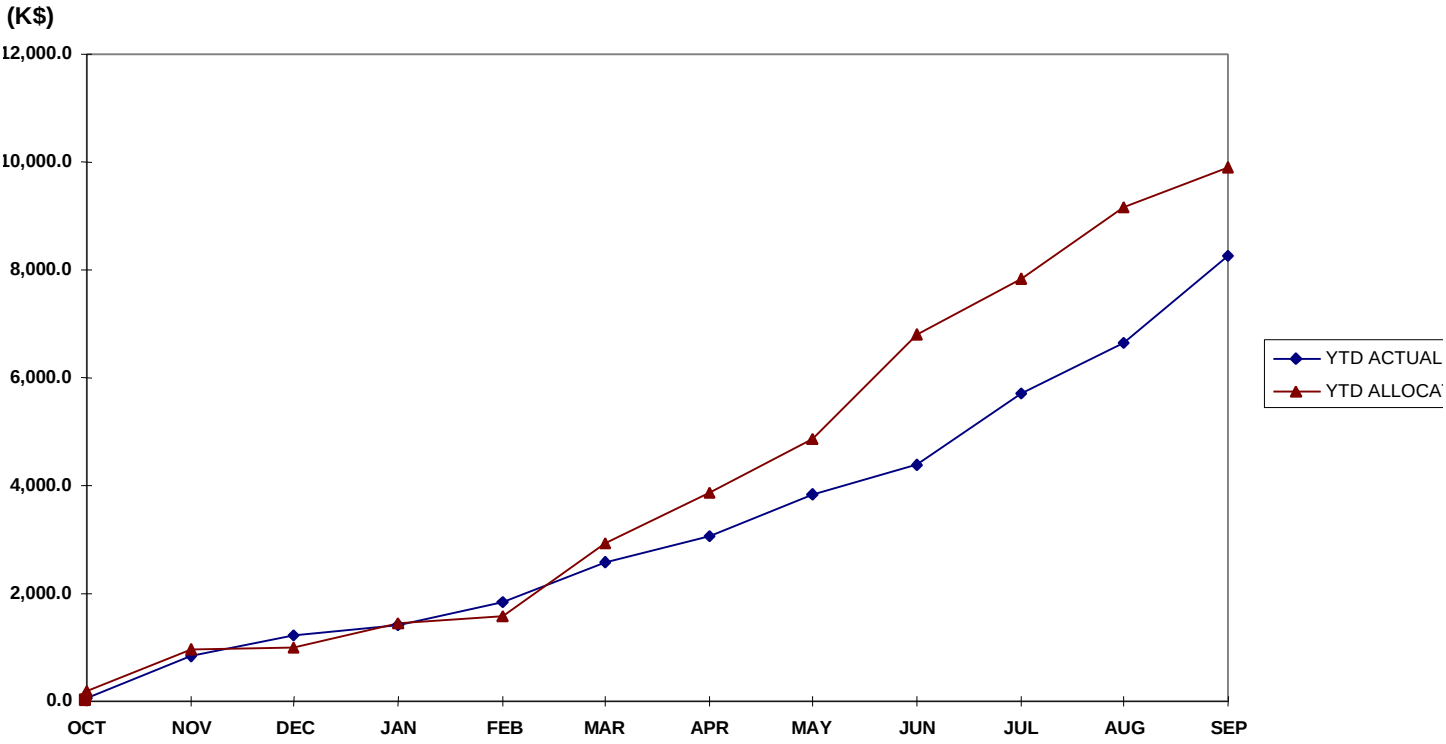
"FY 99 4th QUARTER FINANCIAL SUMMARY"

		COST ESTIMATE	PRIOR YR OBLIG	FY 99 YTD OBLIG	PROJECT BALANCE	D0 FY 99 PLAN	D0 FY 99 BALANCE
1	***TOTAL DZERO UPGRADE PROJECT***	38,532.7	25,531.1	8,264.8	4,736.8	9,910.0	1,645.2
1.1	**TRACKING DETECTORS**	17,319.2	12,256.2	4,185.5	877.4	4,472.5	286.9
1.1.1	SILICON TRACKER	6,480.1	4,051.7	1,990.0	438.3	2,378.4	388.4
1.1.2	FIBER TRACKER	6,881.6	5,218.7	1,516.7	146.2	1,764.4	247.7
1.1.3	CENTRAL PRESHOWER DETECTOR	238.1	238.1	0.1	-0.1	0.0	-0.1
1.1.4	FORWARD PRESHOWER DETECTOR	554.0	432.3	83.0	38.6	69.2	-13.8
1.1.5	TRACKING ELECTRONICS	3,165.4	2,315.4	595.7	254.3	260.4	-335.3
1.2	**CALORIMETER**	4,549.7	3,898.3	232.6	418.8	394.9	162.4
1.2.1	FRONT-END ELECTRONICS	4,247.5	3,650.8	232.3	364.4	363.1	130.9
1.2.2	INTERCRYOSTAT DETECTOR	302.2	247.6	0.3	54.4	31.8	31.5
1.3	**MUON DETECTORS**	9,399.4	5,333.3	2,372.4	1,693.7	3,535.3	1,162.9
1.3.1	COSMIC RAY SCINTILLATOR	1,223.2	963.2	0.0	260.0	0.0	0.0
1.3.2	CENTRAL TRIGGER DETECTORS	908.2	579.6	100.1	228.4	116.1	16.0
1.3.3	FORWARD TRIGGER DETECTOR	2,033.6	1,266.7	307.1	459.8	517.7	210.5
1.3.4	FORWARD TRACKING DETECTOR	1,213.4	725.0	228.8	259.6	453.1	224.3
1.3.5	FRONT-END ELECTRONICS	4,021.0	1,798.7	1,736.3	486.0	2,448.4	712.1
1.4	**TRIGGER**	6,542.4	3,847.9	1,376.3	1,318.2	1,361.4	-14.9
1.4.1	FRAMEWORK	1,637.6	1,637.6	227.2	-227.2	0.0	-227.2
1.4.2	LEVEL 0	136.5	85.4	39.0	12.2	51.3	12.3
1.4.3	LEVEL 1	1,557.9	778.8	341.2	438.0	315.2	-26.0
1.4.4	LEVEL 2	2,084.8	1,144.3	131.1	809.4	394.2	263.1
1.4.5	LEVEL 3	1,125.6	201.9	637.8	285.9	600.6	-37.2
1.5	**ONLINE EQUIPMENT**	722.0	195.4	98.0	428.6	146.0	47.9
1.5.1	ON-LINE EQUIPMENT	722.0	195.4	98.0	428.6	146.0	47.9
3.1	***TOTAL SOLENOID PROJECT***	5,168.0	4,490.5	357.7	319.8	N/A	N/A
3.1.1	SOLENOID	5,168.0	4,490.5	357.7	319.8	N/A	N/A

DEFINITION OF TERMS:

Funds:	**DZero Upgrade = M&S Equipment Funds; Solenoid = AIP Plant Funds.**
Cost Estimate:	**Total Project and Sub-Project Budgets without contingency.**
Contingency Estimate:	**Total Contingency dollars assigned to the Project and Sub-Projects.**
Prior Year Obligations:	**Obligations for fiscal years '92 through '98 as applicable.**
FY 99 Year-to-Date Obligations:	**Obligations for fiscal year '99.**
Project Balance:	**Cost Estimate - (Prior Year Obligations + Fiscal 99 YTD Obligations)**
D0 FY 99 Plan:	**The M&S funds allocated to the Project / Sub-Projects as extracted from the current Project Schedule.**

FY99 OBLIGATIONS
DZERO UPGRADE PROJECT



	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG
CTUAL	68.4	852.6	1,212.3	1,414.9	1,829.2	2,567.5	3,051.7	3,834.3	4,401.8	5,697.5	6,638.4
LLOCATION	208.3	958.4	985.0	1,443.3	1,580.5	2,929.0	3,882.4	4,864.9	6,812.6	7,826.1	9,164.9

DZero Active MoUs as of 9/30/99

	Equipment	R&D	Total Costed
Boston University	298,200	161,500	165,076
Brookhaven National Laboratory	236,439		112,596
Brown University	856,867	106,000	152,644
California State University, Fresno	26,160		0
Columbia University, Nevis Labs	140,000		45,879
DAPNIA / Saclay	0	0	0
IN2P3	0	0	0
Indiana University	109,574		44,574
Institute for High Energy Physics (IHEP)	404,512	15,000	156,911
Institute of Theoretical and Experimental Physics (ITEP)	42,537	5,000	47,437
Joint Institute for Nuclear Research (JINR)	1,391,286	22,000	1,132,590
Kansas State University	210,520	32,500	170,471
Louisiana Tech University	107,692		67,417
Michigan State University	1,445,027		1,011,951
Moscow State University	238,400		187,300
NIKHEF / Amsterdam	0	0	0
Northern Illinois University	143,000	8,000	103,600
Rice University		35,656	35,656
SUNY at Stony Brook	1,105,750	20,000	104,406
University of Arizona	747,648	256,500	365,504
University of Calif, Davis		9,720	0
University of Calif, Irvine	48,800		28,449
University of Calif, Riverside	89,116		84,310
University of IL, Chicago	129,103	22,000	66,001
University of Kansas, Center for Research, Inc.	16,000		0
University of Maryland	221,000		148,329
University of Michigan	206,500		167,897
University of Nebraska, Lincoln	95,913		0
University of Notre Dame	167,000	77,000	181,728
University of Oklahoma	43,000		27,994
University of Texas, Arlington	126,764		76,917
University of Washington	50,640	5,250	0
Total Fermilab Funds:	$8,697,448	$776,126	
Total Costed:	4,037,953	647,683	$4,685,636
Total Open Commitments:	$4,659,494	$128,443	